agito

Motion Controls and Drives

Centralized Network Control

Precision

Cost

Force control

Perfect solutions

Analog

High precision motion

Drive

Acceleration

Gain schedule

Repeatability

High performance

Semiconductors

Performance

CNC

Central-i Patent

Torque

Patented technology

Amplifiers Integrated controllers

Dual loop

Printing

Centralized control

Amplifiers

Controller

Accuracy

Industry 4.0

Advanced algorithms

DC servo drives

Frequency domain

Data recording

Better machine

3C

Force

Machine heath

Compensation

Speed

High precision motion

3D Error correction

Multi-axis

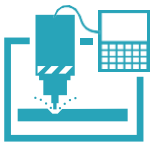
Multi-axis motion controllers

Gantry controller

Agito is an Israeli company based on many years of experience designing high performance motion control products and systems. Agito (Agito means "to put in motion" in Latin) main activity is development and sales of motion control products (controllers, amplifiers, drives, integrated controls, I/O modules and more). Agito supports its customers during the entire development process of the product or machine. From the design stage to the serial production, to support industrial machinery performance demands, Agito developed a distributed control fieldbus known as Central-i. Central-i is an innovative, patented topology for motion control systems. At the center of a Central-i system, there is a multi-axes master controller and remote amplifiers. The involvement and responsibility of the company start when the control system is defined, and continues through selecting the various system components, simulations if needed, system assembly, tuning, programming, testing, documentation and support during serial production.

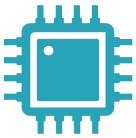
Industries That We Serve

Or simply anything that needs to move ...



Machine tools

Robots

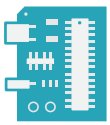


Semiconductors

Communication

Display

Renewable energy



Printed circuit board assembly & test

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About Agito Control Solutions

The state-of-the-art and innovative control technology from Agito provides a comprehensive list of features ,that allow to meet the most demanding performance applications in the markets.

The control solution is ideal for controlling direct drive and servo motors, providing highly coordinated multi-axis motion with excellent position/velocity tracking and settling performance. The controllers support many advanced features like active yaw gantry control, force control, CNC modes, user programs and 2D/3D error compensation as standard features, having user friendly configuration tools for easy implementation.

The high-performance motion controllers are designed to operate standalone without external host controller. They can also be working under an external HMI, possibly with a PC or PLC, through standard communication network, like Ethernet, CAN, RS232, RS485 or USB (all supported simultaneously).

The centralized control unit products come with integrated amplifiers, resulted in a very cost-effective solution for standalone low axis-count application like XYZ or XY-Theta stage for semi-automated microscopes or inspection systems.

To support industrial machinery performance demands, Agito developed a distributed control fieldbus known as Central-i.Central-i is an innovative, patented topology for motion control systems. At the center of a Central-i system, there is a multi-axes master controller. All the control algorithms are performed by the master controller including trajectory planning, position, velocity and current loops (all in 16KHz). The remote units receive the results of the algorithms via a simple and highly efficient digital protocol. All remote units do not require any computational resources or configuration/setup memory, so they are very cost effective and easy to use/maintain. All communication with remote devices, as well as their power PWM signals are synchronized down to 8 nano-seconds due to the nature of the Central-i's star communication topology.

Setting up a Central-i system is as easy as plugging in the cables. The system adapts itself to the connected remote devices, without the need to learn complex networking protocols, object items, etc. Although the hardware is distributed, the entire system behaves as a centralized control architecture, where the master controller has access to all signals at the remote devices at each of the 16 kHz sampling cycles. The system designer designs the system as a distributed system (flexible location and type of remote units) while the system integrator configures, tunes and programs the system as it was a full centralized control unit, with all configuration, data and calculations stored and executed at a single unit (the master).

Centralized Control Solutions

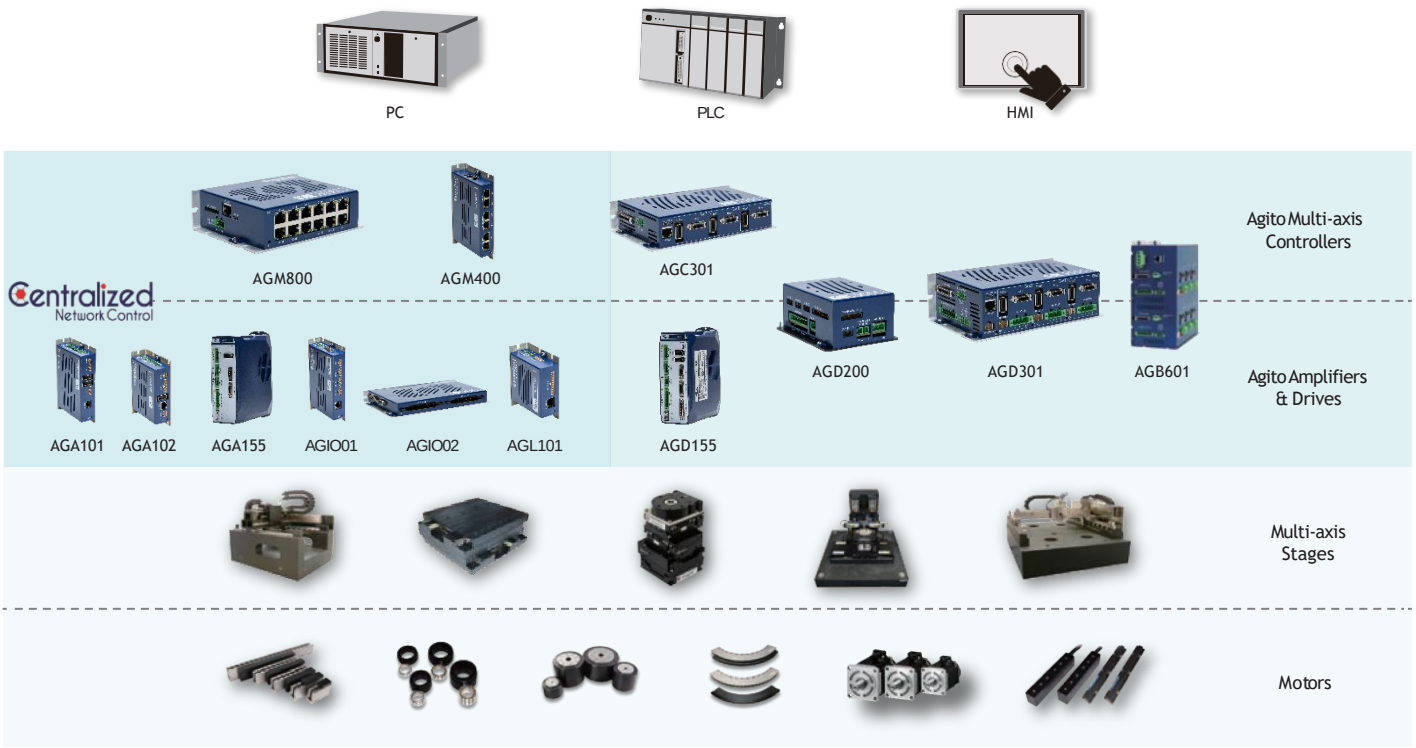
The AGC, AGD and AGB series of products provide an extremely high-performance motion control platform for highly coordinated applications with demanding control performance in terms of position and velocity tracking, fast settling time and low jitter. The controller is running at 16KHz for position, velocity and current loops and the built-in amplifiers output their PWM at 32KHz. While best performance is achieved by using the integrated amplifiers, these products can also control external drives with different power ratings and connector interfaces that are necessary for certain applications.

A common software and firmware platform for the AGC, AGD and AGB series of products means it is easy to scale the hardware configuration to move between external drive and integrated amplifiers, or when adding more axes or controllers to the host network.

The standalone user program is running directly on the controller DSP, it has full access to the controller's low-level signals and parameters. resulting in a highly flexible and responsive controller. The user program is written in a simple script-based language, it is easy for any engineer to program, even for non-software-trained engineers. Covered features are: multi-tasking, functions, if/while/for/switch blocks, event functions, expressions, single step, break-points, watch window and much more.

In addition to executing the standalone program in the DSP, the PC based AAMotion API library provides an easy interface for Microsoft .Net environment users. These products support a wide variety of communication protocols like Ethernet TCP/IP, CAN bus, USB, RS232 and RS485, users can easily program the controller in various operating systems.

The products are packaged with a rich collection of functional features, like auto tuning, closed-loop force control, active-yaw gantry control, CNC/ECAM/Gear/Vector motions and the innovative Ultra Precision Mode (UPM) algorithms and much more. This series of products are also designed with many safety protections, such as current limit (incl. I2T), over-temperature, ESD protection and even reversed-polarity protection in the main power supply connection.



AGC Series – Multi-axis Controllers

AGC series is a family of high performance, standalone 3-axis controllers with Ethernet, USB, CAN bus, RS232 and RS485 communication ports to interface with any kind of host devices. It can control any external drivers, either in analog +/-10V format or digital Pulse & Direction format. It has 18 digital inputs, 17 digital outputs, 4 analog inputs, 4 analog outputs and 8 bi-directional differential I/Os. Supporting 3-axis coordinated motion, this controller is very suitable to control XYZ stages, XY-Theta stages, flexible-link gantry, SCARA robot, tip-tilt stages, etc.

General Specifications

Description	AGC300-ET	AGC301-ET
Number of Axes	3	
Power Supply	9-36VDC	
Isolated Inputs[1]	11	18
Isolated Outputs[2]	4	17
Differential Input (RS422)	8	8 Bi-Directional Differential I/Os (software configurable as input or output)
Differential Output (RS422)	4	
Analog Inputs[3]	4 (12-bit or 16-bit)	
Analog Outputs	4 (16-bit)	
Encoder Input	3 Ports (each port is software configurable as AquadB, Absolute Biss-C or EnDat2.2[4]). Ports 1 and 2 support also Sin/Cos 1Vpp encoders.	3 Ports (each port is software configurable as AquadB, Sin/Cos 1Vpp, Absolute Biss-C or EnDat2.2).
Communication to Host	Ethernet, CAN bus, RS232, USB, RS485	
Control Filter Sampling Rate	16 KHz (position, velocity, optional force, current)	
Operational Modes	Position, Velocity, Force or Current (Torque) modes	
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNC sequential contour (G-codes), Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.	
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.	
Programming Interfaces	Standalone User Program – high level script-based program executed in the controller(up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CAN format.	

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. 16-bit analog inputs available in some product options. Consult your sales channel.
4. EnDat 2.2 supported by dedicated FPGA version (consult with sales engineer).

AGD155 Series – Single-axis Intelligent 220 VACDrives

AGD155 is an AC powered single-axis intelligent drive. While it is a fully featured single-axis stand-alone controller, it also comes with analog input to receive +/-10V current or velocity command, and Pulse & Direction input as position command. It can drive various types of motors like voice coil, brushed or brushless motor, including direct-drive linear and rotary motors. AGD155 can also synchronize with other axes in an Ethernet, CAN or RS485 network. The internal standalone program supports up to 8 multi-threading tasks, each can be configured with different priority. With an external PC or PLC as a system level controller, AGD155 can be used in a synchronized, multi-axis environment.

AGD155

General Specifications

Description	AGD155-PA-2A03	AGD155-PA-2A06	AGD155-AF-2A06	AGD155-AF-2A10
Number of Axes	1			
Power Supply (1-φ or 3-φ)	110 to 240 VAC			
Continuous Current	3 Arms	6 Arms	6 Arms	10 Arms
Peak Current	9 Arms	18 Arms	18 Arms	20 Arms
Isolated Inputs[1]	9		16	
Isolated Outputs[2]	4		6	
Differential Inputs (RS422)	3		3	
Differential Outputs (RS422)	4		4	
Bi-Directional Differential I/Os (RS422)	0		1	
Analog Inputs	2 (14-bit)		2 (16-bit)	
Analog Outputs	0		2 (16-bit)	
PT100 Input	0		1 (0 to 130°C)	
Brake Output[3]	0		1	
Regeneration Output	1		1	
Encoder Inputs	1 Configurable as AquadB, Absolute Biss-C or EnDat2.2		2 Each port is software configurable as AquadB, Absolute Biss-C or EnDat2.2. The second port also support sin/cos	
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)			
Communication	RS232, USB		Ethernet, RS232, CAN, USB, RS485	
Control Sampling Rate	16 KHz (profiler, position, velocity, optional force, current)			
Operational Modes	Position, Velocity, Force or Current (Torque) modes			
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNC sequential contour (G-codes), Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.			
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.			
Programming Interfaces	Standalone User Program – high level script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CAN format.			

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. Brake output up to 48VDC, 3A.

AGD200 Series – Motion Controller with Integrated Drives

AGD200

AGD200 series is a family of compact, high performance motion control units with 2 integrated servo amplifiers, allowing it driving 2 motors and control third axis through an external drive. It is equipped with Ethernet, USB, CAN bus, RS232 and RS485 communication ports to interface with any host devices. With 16 kHz sampling frequency, this product is ideal for any tightly coordinated motion systems. It supports a very wide range of bus-voltage from 12Vdc to 90Vdc and each axis can supply up to 5.6Arms continuous current and 11.2Arms peak current concurrently.

Equipped with a plethora of I/Os: 11 isolated digital inputs, 4 isolated digital output, 4 analog inputs, 4 analog outputs and 8 differential inputs, this product is fully capable of handling stand-alone applications. The typical use case of this product is in 3D printers, security surveillance camera systems, mobile robots, and factory automations.

General Specifications

Description	AGD200-ET-2D01	AGD200-ET-2D02	AGD200-ET-2D05
Number of Axes	2 (3rd axis with external drive)		
Power Supply	12-90 VDC		
Logic Power Supply (Optional)	12-36 VDC		
Continuous Current	1.4 Arms	2.8 Arms	5.6 Arms
Peak Current	2.8 Arms	5.6 Arms	11.2 Arms
Isolated Inputs[1]	11		
Isolated Outputs[2]	4		
Differential Inputs	8		
Differential Outputs	4		
Analog Inputs[3]	4 (12-bit, 16 bits analog input with extension board)		
Analog Outputs	4 (16-bit)		
Brake Output[4]	2		
Encoder Inputs	3 Ports (each port is software configurable as AquadB, Absolute Biss-C or EnDat2.2[5]). Ports 1 and 2 support also Sin/Cos 1Vppencoders		
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)		
Communication	Ethernet, CANbus, RS232, USB, RS485		
Control Sampling Rate	16 KHz (profiler, position, velocity, optional force, current)		
Operational Modes	Position, Velocity, Force or Current (Torque) modes		
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNCsequential contour (G-codes) , Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.		
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.		
Programming Interfaces	Standalone User Program – high level script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CANformat.		

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. 16-bit analog inputs available in some product options. Consult your sales channel.
4. Brake output up to 48VDC, 3A each.
5. EnDat 2.2 supported by dedicated FPGAversion (consult with sales engineer).

AGD301 Series – Motion Controller with Integrated Drives

AGD301 series is a family of standalone, high performance 3-axis motion control units with integrated servo amplifiers, It is equipped with Ethernet, USB, CAN bus, RS232 and RS485 communication ports to interface with any host devices such as PC, PLC, HMI, etc. With 16 kHz sampling (profiler, position, velocity, optional force and current control loops) frequency, this product is ideal for any tightly coordinated motion systems, such as XYZ or XY-Theta stage, flexible-link gantry stages, Z-Theta or XZ-Theta pick and place modules, etc.

AGD301 can drive up to 3 voice coils, brushed or brushless servo motors or stepper motors, allowing very flexible configuration of the motors in the multi-axis system. It supports a very wide range of bus-voltage from 12Vdc to 90Vdc and each axis can supply up to 5.6Arms continuous current and 11.2Arms peak current concurrently. It is suitable to drive very small voice coil or brushed motors at 12Vdc, and is also capable drive 3 big motors with 0.5kW continuous power each.

AGD301

General Specifications

Description	AGD301-ET-2D05	AGD301-ET-2D09-001
Number of Axes	3	
Power Supply	12-90 VDC	
Logic Power (optional)	12-36VDC	
Continuous Current	5.6 Arms per axis	9 Arms per axis[7]
Peak Current	11.2 Arms per axis	18.2 Arms per axis
Isolated Inputs[1]	27	
Isolated Outputs[2]	17	
Bi-Directional Differential I/Os (RS422)	8	
Analog Inputs[3]	4 (12-bit)	4 (16-bit)
Analog Outputs	4 (16-bit)	
PT100/PT1000 Inputs[4]	3	
Brake Output[5]	3	
Hall Sensors Inputs[6]	3	
Regeneration Output	1	
Encoder Inputs	3 Ports (each port is software configurable as AquadB, Sin/Cos 1Vpp, Absolute BiSS-C or EnDat2.2).	
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)	
Communication	Ethernet, RS232, CAN, USB, RS485	
Control Sampling Rate	16 kHz sampling rate for current, velocity and position control loops	
Operational Modes	Position, Velocity, optional Force or Current modes	
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNC sequential contour (G-codes), Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.	
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.	
Programming Interfaces	Standalone User Program – script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CAN format.	

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. 16-bit analog inputs available in some product options. Consult your sales channel.
4. Hardware switch to select between PT100 and PT1000.
5. Brake output up to 48VDC, 3A each.
6. Part of general purpose inputs with internal 5V power supply.
7. Limited to 20 Arms for 3 axes in total.

AGB600 Series –Motion Controller with Integrated Drives

The AGB600 series can control 6 voice coils, brushed or brushless motors. Internally, the AGB600 consists of 2 units of either AGD301 and/or AGC301 with an Ethernet hub to connect between the 2 units. It comes in 3 variants: 6 controller axes, 6 integrated-drive axes, and 3 controller axes plus 3 integrated-drive axes. The controller axes can control external drives through analog +/-10V command or digital Pulse & Direction command. With these variants, it is possible to control any 6-axis systems where each group of 3 axes can be moving in tightly coordinated motion. Between the 2 controller units, the user program can access all the parameters in the other controller via CAN communication. With an external host, the 2 controllers can be coordinated by the host via a common Ethernet network. The Windows .Net API, AAMotion, is designed to handle such multi-controller systems.

AGB600

General Specifications

Description	AGB600-6C	AGB600-6C6D	AGB600-6C3D
Number of Axes	6		
Integrated Drives	0	6	3
Power Supply	12-90 VDC		
Logic Power (optional)	12-36VDC		
Continuous Current	NA	5.6 or 9.2 Arms peraxis	5.6 or 9.2 Arms peraxis
Peak Current	NA	10.2 or 18.2 Armsper axis	10.2 or 18.2 Armsper axis
Isolated Inputs[1]	36	54	45
Isolated Outputs[2]	34		
Bi-Directional Differential I/Os (RS422)	16		
Analog Inputs[3]	8 (12-bit)		
Analog Outputs	8 (16-bit)		
PT100/PT1000 Inputs[4]	NA	6	3
Brake Output[5]	NA	6	3
Hall Sensors Inputs[6]	3	6	3
Regeneration Output	0	2	1
Encoder Port	6 Ports (each port is software configurable as AquadB, Sin/Cos 1Vpp, Absolute BiSS-C or EnDat2.2).		
Motor Types	NA	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)	
Communication	Ethernet, RS232, CAN, USB, RS485		
Control Sampling Rate	16 kHz sampling rate for current, velocity and position control loops.		
Operational Modes	Position, Velocity, Optional Force or Current Modes		
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNCsequential contour (G-codes), Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.		
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.		
Programming Interfaces	Standalone User Program – script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CANformat.		

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. 16-bit analog inputs available in some product options. Consult your sales channel.
4. Hardware switch to select between PT100 and PT1000.
5. Brake output up to 48VDC, 3A each.
6. Part of general purpose inputs with internal 5V power supply.

There are many applications that prefer to have amplifiers near the motors, while the controller can be located near the host PC, PLC or HMI. In such cases, the solution is to use a networked (distributed) motion control architecture.

The Central-i network topology is invented and designed to distribute the amplifier hardware from the centralized controller unit while keeping the machine control, as well as all control algorithms in a centralized processing unit. This is an ideal topology to enjoy the advantages of centralized control, providing excellent multi-axis coordination and control, while simplifying the electrical interface by placing the amplifiers near each motor.

The Central-i network is basically a star-topology network where the remote amplifiers or I/O modules are connected directly to the master controller with a standard CAT5 cable, using Central-i Link digital communication. The master controller is closing all the servo loops for all axes, including position, velocity, force and even the current loops. As each remote unit is connected to the master controller by a dedicated cable, the communication bandwidth is deterministic, and the communication protocol is extremely simple. When the master controller detected a connection, it receives the hardware ID of the remote unit and immediately knows what data, and their sequence, to be received and transmitted from the remote unit. As each remote unit has a dedicated data line to the controller, all axes data are read and transmitted in parallel. There is amber time for data transmission, so all the sensor signals and command are transmitted at every sampling cycle. Therefore, to the master controller, all the remote units behave as if they are physically local (centralized) although practically they are distributed with full flexibility regarding the type and location of each remote amplifier/motor.

Centralized
Network Control

The Central-i network solution allows a very flexible configuration of different amplifiers. For example, the first amplifier axis can be powered by a 12Vdc power supply to drive a small voice coil motor, the second amplifier can be powered at 80Vdc for an ironless linear motor, the next amplifier can be a 230Vac amplifier to drive a big DDR motor. Depending on the number of I/O required, there can be multiple I/O modules connected to the master controller. All I/Os signal are updated at the master controller every sampling interrupt or about 61 micro-seconds, there is no communication delay despite being distributed in a network.

If there is a need to use any third-party drive, the Central-i product family has a series of adapters to translate the Central-i current command into +/-10V signal and position command into pulse and direction format. These are standard interfaces supported by many off-the-shelf drives available in the market.

Central-i Network Control Solutions

AGM Series – Central-i Multi-axis Master Controllers

AGM series is a family of high performance 4-axes and 8-axes Central-i master controllers, which are equipped with up to 12 Central-i ports. 8 ports can be connected to any remote Central-i amplifier, while the remaining ports can be connected to any remote I/O module. AGM series is equipped with large flash/RAM memories to support complex applications and features, such as CNC motion and 3D error mapping. AGM is centralized motion controller and executes motion profiler and all servo control loops internally at 16 kHz sampling rate, that allow perfect multi-axis synchronization at better than 1 micro-second level. That make AGM series perfectly fit to high precision coordinated motion applications, such as CNC, Semiconductors,Electronic Assembly, and robotics.

AGM800

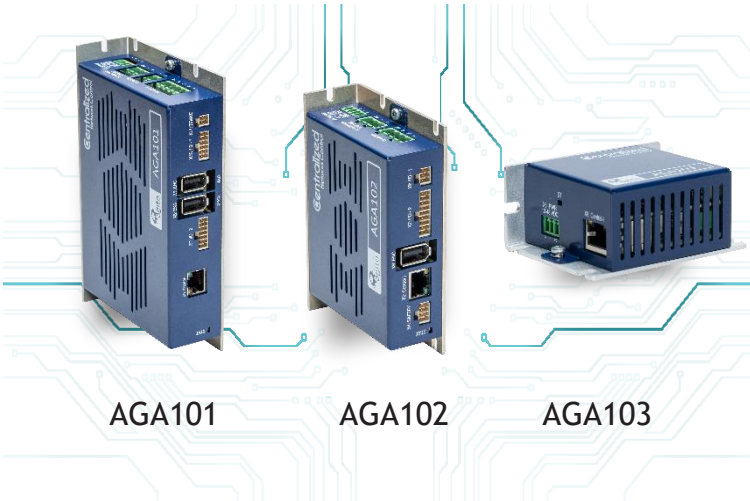
AGM400

General Specifications

Description	AGM800-CI	AGM400-CI
Number of Central-i Ports	12	6
Number of Axes	8	4
Power Supply	9-36VDC	
CPU	ARM Cortex A9, 900MHz dual core	Texas Instruments DSP 300Mhz
Flash Memory	128 MB (+SD card)	2MB
RAM	8 GB	500KB
Communication	Ethernet, RS232	Ethernet, RS232, CAN, USB, RS485
Fieldbus to Amplifiers and I/O	Central-i	
Control Sampling Rate	16 KHz (position, velocity, optional force, current)	
Operational Modes	Position, Velocity, Force or Current (Torque) modes	
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.	
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.	
Interface to Camera/Laser	Via fast differential or optically isolated I/O in remote AGIO: Event – position output event (1D or 2D) , Lock – position capture , User programmable PWM output via remote unit with 1MHz frequency	
CNC Mode	CNC sequential contour (G-codes) support, FIFO buffering, Corners compensation, Linear, Circular and Helical interpolations	
Homing Modes	User programmable: on encoder index, home switch, limit switch and hard stop. (easily configurable to any sequence)	
Commutation	Motor learning, Auto phasing (for incremental encoders), by halls, by abs encoder	
Programming Interfaces	Standalone multi-tasking user programs – high level script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread. More than 300 commands per 1 msec). IDE integrated in PCSuite Windows .Net API - available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CAN format.	

AGA10x Series – Central-i DC Remote Amplifiers

The AGA10x series is family of Central-i remote power amplifiers. AGA amplifiers are controlled by AGM series Central-i master, which gets encoder reading and current samples from each amplifier, performs control loops calculation and generate PWM commands to each amplifier. Fast Central-i fieldbus is used to communicate between AGA amplifiers and AGM master, that allows 16kHz sample rate motion profiler and all servo loops. Amplifiers are powered by 12-90V DC power supply. To support remote operation and minimize cables length from the actuator, each remote amplifier is equipped with variety of digital and analog I/Os.



The isolated digital outputs are capable of sourcing up to 300mA or sinking up 500mA. This is sufficient to drive most external devices, end effectors, etc., hence, eliminated the need to have an external relay circuit. The compact form factor of the DC amplifiers is ideal for them to be mounted close to the actuator, such as the link in an articulated robot arm.The AGA10x series is family of Central-i remote power amplifiers.

General Specifications

Description	AGA101-CI-2D01/2D02/2D05	AGA102-CI-1D01/1D02/1D05	AGA103-CI4[4]
Number of Axes	1		
Power Supply	12-90 VDC	12-48 VDC	
Continuous Current (Arms)	1.4 / 2.8 / 5.6	1.4 / 2.8 / 5.6	2.8
Peak Current (Arms)	2.8 / 5.6 / 11.2	2.8 / 5.6 / 11.2	5.6
Isolated Inputs[1]	11	7	5[6]
Isolated Outputs[2]	3	2	2
Bi-Directional Differential I/Os (RS422)	1		
Analog Inputs[3]	2 (12-bit)	1 (12-bit)	2 (12-bit)
Analog Outputs	0		
PT100/PT1000	0		
Brake Output[5]	1	0	
Regeneration Output	1	0	
Encoder Port 1	Configurable as AquadB, Absolute Biss-C or EnDat2.2 Port	Configurable as AquadB, Sin/Cos 1Vpp, Absolute Biss-C or EnDat2.2	Configurable as AquadB, Sin/Cos 1Vp, Absolute Biss-C or EnDat2.2
Encoder Port 2	Configurable as AquadB, Sin/Cos 1Vpp, Absolute Biss-C or EnDat2.2	NA	NA
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)		
Communication	Central-i		
Sampling Rate	16 KHz		

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. Hardware option for 16-bit available.
4. Upcoming in Q1 2021.
5. Brake output up to 48VDC, 3A.
6. Digital isolated input can be configured as NPN(sinking).

AGA155 Series – Central-i 220 VACRemote Amplifiers

The AGA155 series is a family of 220VAC Central-i remote power amplifiers. AGA amplifiers are controlled by AGM series Central-i master, which gets encoder reading and current samples from each amplifier, performs control loops calculation and generate PWM commands to each amplifier. Fast Central-i fieldbus is used to communicate between AGA amplifiers and AGM master, that allows 16kHz sample rate motion profiler and all servo loops. The AC powered remote amplifier is capable of driving motor up to 10 Arms continuous and 20 Arms peak current. The amplifier comes with heat sink and cooling fan, is ideal for high power motors, including big direct drive linear and rotary motors. Similar to the DC powered AGA10x amplifiers, the AGA155 amplifier also comes with digital and analog I/Os sufficient for a typical actuator and application. The digital outputs are capable of sourcing up to 300mA or sinking up 500mA. This is sufficient to drive most external devices, end effectors, etc., hence, eliminated the need to have an external relay circuit.

General Specifications

Description	AGA155-CI-2A03	AGA155-CI-2A06	AGA155-CI-2A10
Number of Axes	1		
Power Supply	110-240 VAC		
Continuous Current	3 Arms	6 Arms	10 Arms
Peak Current	9 Arms	18 Arms	20 Arms
Isolated Inputs[1]	9		
Isolated Outputs[2]	2		
Bi-Directional Differential I/Os (RS422)	1		
Analog Inputs	2 (12-bit optional 16-bit)		
Analog Outputs	0		
PT100/PT1000 Inputs[3]	1		
Brake Output	1		
Regeneration Output	1		
Encoder Ports	1 software configurable as AquadB, Sin/Cos 1Vpp, Absolute Biss-C or EnDat2.2		
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)		
Communication	Central-i		
Sampling Rate	16 KHz		

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.
3. Wiring of PT1000 different from PT100, refer to manual for details.

AGIO Series – Central-i Remote I/O Units

The AGIO is a series of Central-i remote I/O modules. used to expand the number of I/O interfaces in the Central-i network.
Since all the I/O modules are updated at the master controller every sampling cycle, there is no difference between connecting, for example, an axis limit sensor to the axis amplifier's digital input or to a separate AGIO module. The master controller receives the AGIO digital input signal at the same time as the AGA amplifier's digital input, at 61 micro-second interval.
Most of the inputs are configurable to connect NPN or PNP sensors. And most of the outputs are software configurable to sink or source current. Typically, each output can sink down to 500mA and source up to 300mA of current. This is sufficient to drive most relays and solenoids directly.

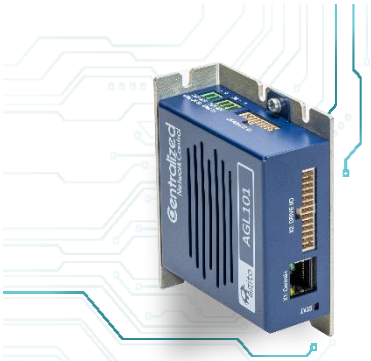
General Specifications

Description	AGIO01-CI-1608	AGIO02-CI-3216
Communication	Central-i	
Power Supply	9 to 36VDC	
Sampling Rate	16 KHz	
Differential Bi-Directional I/O	3	
Isolated Inputs[1]	16	32
Isolated Outputs[2]	8	16
Analog Inputs	4 (12-bit resolution)	4 (12-bit resolution)
Analog Outputs	0	2 (16-bit resolution)

1. Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
2. Digital isolated output can sink up to 500mA or source up to 300mA.

AGL Series – Central-i Remote Adapter

The AGL is a series of Central-i remote adapters to interface the Central-I network with external devices, such as drives. The AGL adapters can convert the current command into analog +/-10V signal or convert position command into pulse and direction format. This will allow the Central-i master to control any third-party drives in analog current mode or digital pulse and direction mode; hence, extending the Central-i network to work with any servo drives.



AGL101

AGL102

General Specifications

Description	AGL101-CI	AGL102-CI
Number of Axis	1	
Power Supply	9 – 36 Vdc	
Communication	Central-i	
Supported Encoder Type	1 AquadB or absolute BiSS-C	1 AquadB
Isolated Inputs[1]	5	4
Isolated Outputs	6[2]	4 (sinking, down to 50mA)
Differential Outputs	2	0
Differential Bidirectional I/Os	1	0
Analog Inputs	2 (16-bit resolution)	1 (12-bit resolution)
Analog Outputs	1 (16-bit resolution)	1 (16-bit resolution)

1. Digital isolated input can be configured as NPN or PNP, in groups of 2 or 3.
2. AGL101-CI provides 3 digital output that can sink up to 500mA or source up to 300mA. The other 3 outputs are sink only.

PCSuite Software and Libraries

All Agito controllers are provided with the comprehensive, market leading, PCSuite software. The PCSuite is a Windows® based software environment to configure, tune, program and operate all controllers, drives and Central-i master units in this catalog.

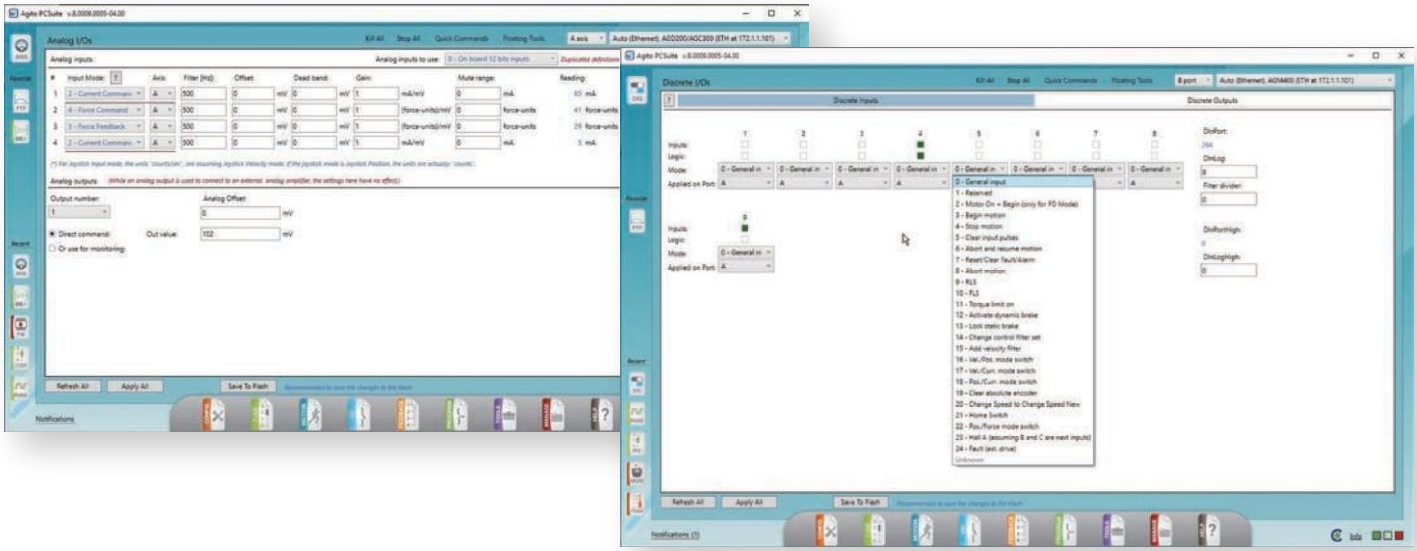
- Auto Tune
- Identification
- Frequency Domain Analysis
- System model and simulation
- Configuration wizard
- Error Mapping 1D, 2D and 3D
- Real time data recording
- Bode, Nichols
- IDE+
- User program / debugger
- Machine health
- Motion modes

The PCSuite is uniquely providing a graphic interface to configure, tune and experiment every motion and control feature of Agito controllers, including (partial list): configuration wizards, time domain tuning, plant identification, frequency domain design, auto tuning and much more. Each feature has a dedicated GUI tool (page) that is optimally designed to provide ease of use together with access to every related parameter and feature's options. At the same time, variety of floating windows, including user defined GUI elements are provided to enable access to any status/control parameter, from anywhere within the PCSuite.

Navigation between the various tools is made easy by an icons-based menu, together with variety of shortcuts and ability to one click access to recent and favourite tools.

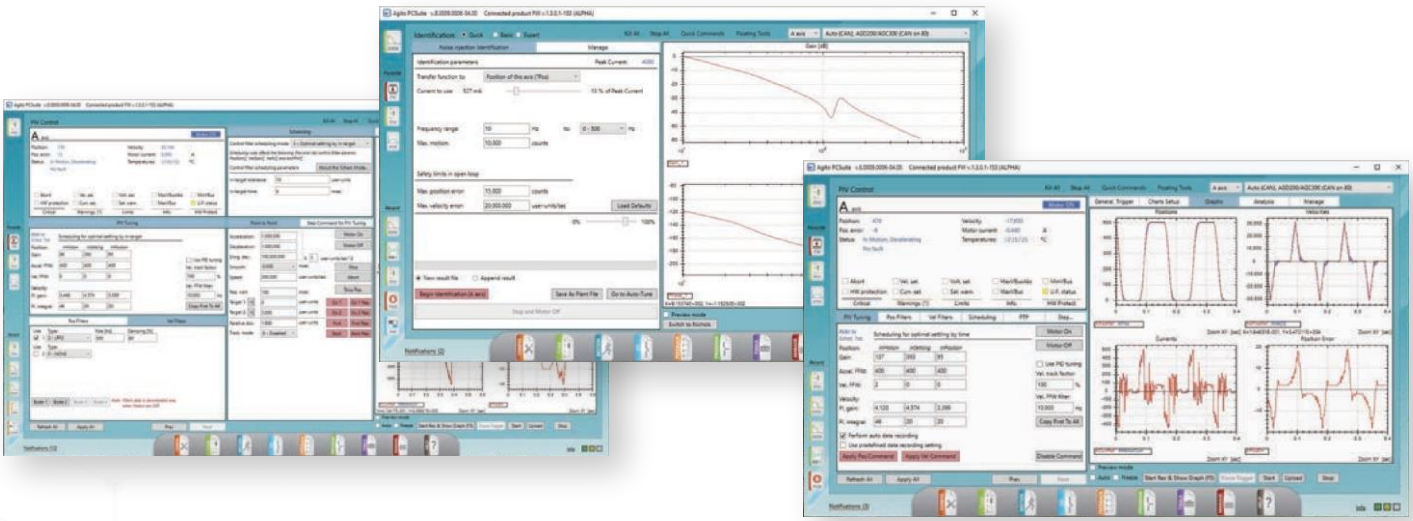
Flexibility and Programmability

Most controller features are fully flexible and programmable. This covers, for example: Special functionalities of digital inputs, digital outputs, analog inputs, analog outputs, master of ECAM motion, source of current/force command, Halls connections, motor phases connections, Homing behaviour and much more. The PC Suite provides intuitive GUI to control and setup all this flexibility.



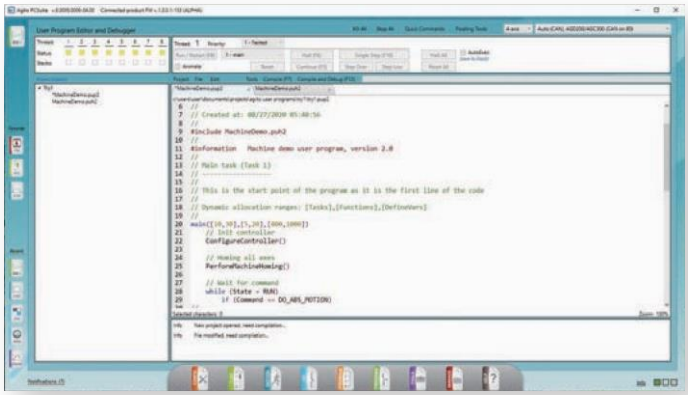
Graphic Display

The PCSuite is equipped with a comprehensive tool to display graphs (recorded data in the time domain, plant, open loop and closed loop in the frequency domain), consisting of: multiple zoom methods, analysis of displayed data (RMS, tolerance, amplitude, frequency…), markers, riders, FFT and much more…



Standalone User Program (Multi-threaded)

The PCSuite includes a powerful and comprehensive integrated development environment, IDE+, for user to develop machine sequences and to enable standalone operation of the control unit.



It supports multi-threading of up to 8 tasks simultaneously, using intuitive script language to manage program flow using if/for/while/switch-case flow control blocks. User can create variables and expressions, setup interrupt event functions and even use C-language-like pointers to access variable by memory addresses.

Depending on product/application, the control unit can execute up to 500 low level command in 1 milliseconds. The IDE+ supports multiple project files, allow user to group commonly used functions in a separate file that can be reused by many projects. The IDE+ debugger also supports single-step execution, break-points and watch windows for easy debugging of the user program.

Communication and Library

▶PCSuite is provided with a low-level and high-level communication library (API) for users to develop their Application software. The libraries are provided in native Windows' .NET environment, it has been extended to .NET Core Environment. The API can also be used in MATLAB, Labview and other environment compatible with Windows' .NET framework.

▶The PCSuite (and its library) supports Ethernet, CANBus, RS-232 and USB. It can auto detect connected controllers and auto-connect to the first controller.

▶In other environment, the external host can communicate with the control units by standard TCP/IP socket programming, CAN or RS-232 communication protocols.

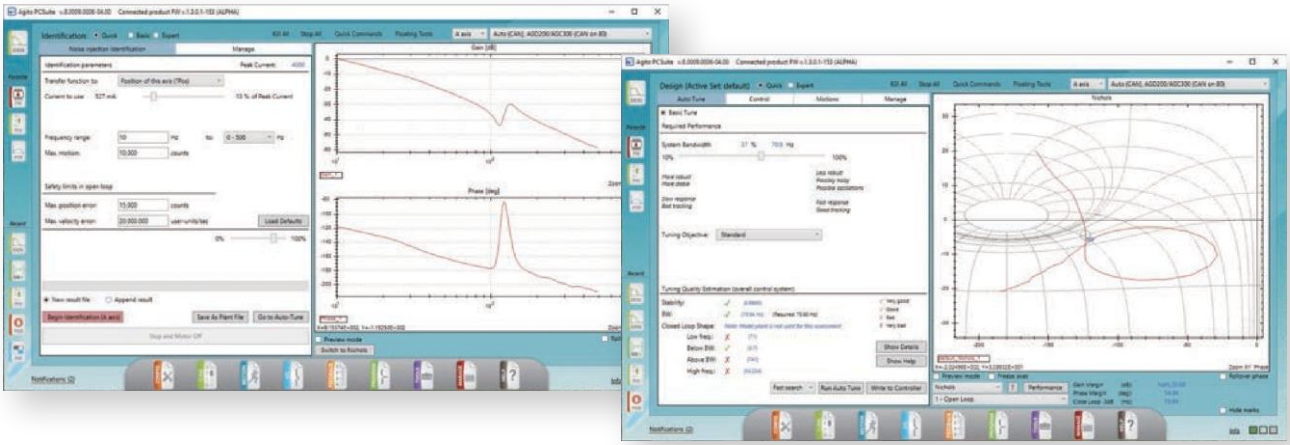
Examples of the PCSuite variety of interfaces are presented in subsequent section about common control and application features of Agito controller.

Common Control and Application Features

Frequency Domain Analysis

IDEN

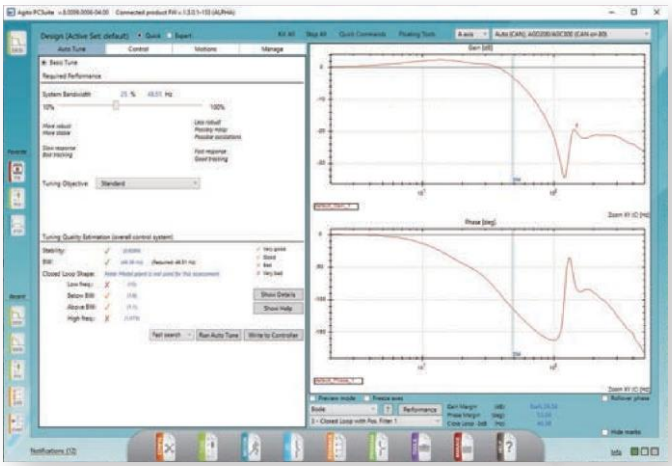
Modern control theory focused mainly in frequency domain. Agito controllers support frequency domain plant identification, allowing easy identification of the plant characteristics and mechanical resonances (from a single click Quick mode, to intensive Expert mode for difficult systems and expert users). The PCSuite software can even automatically and accurately estimate the parametric model of the plant, allowing advanced users to perform in-depth analysis and optimization of the system.



Advanced Auto-tuning Algorithm

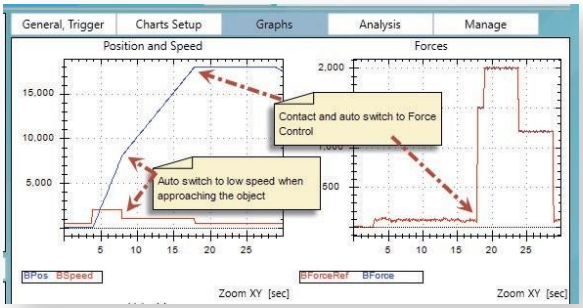
DESI

Advanced auto-loop-shaping algorithm in the frequency domain is used to calculate the most optimized gains and filters for the identified plant(s). The basic mode allows user to auto-tune the system with a click of a button, while the expert mode provides all the controls to the user to fully optimize the calculation of control loops gains and filters. The result could out-perform most manual tuning. User can inspect the plant bode, open loop, closed loop and disturbance rejection, as well as the automatically calculated gain/phase margins, crossing frequency, -3dB frequency, peak gain and other open loop and closed loop characteristics. Bode and Nichols chart are supported, and the user can store and compare up to 6 different control filters designs.



Force Control and Mode Switching

Smooth transition between high speed motion to low speed searching for contact point and finally switch automatically to force mode or current mode to press with multiple step or ramp force profile. Upon completing the force profile, automatically switching back to position mode to move back to start point at high speed.

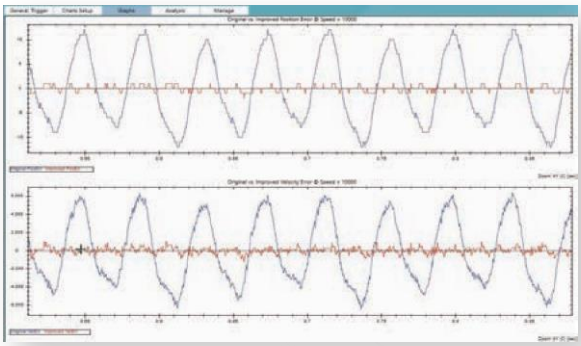


This feature is commonly used in semiconductor die-attach, pick and place, glass/touch panel processing, etc.

The controller achieved high accuracy closed-loop force control at 16kHz with force sensor feedback via the high resolution analog input. If force sensor is not used, the controller controls the current loop with the built-in high resolution current feedback sensor.

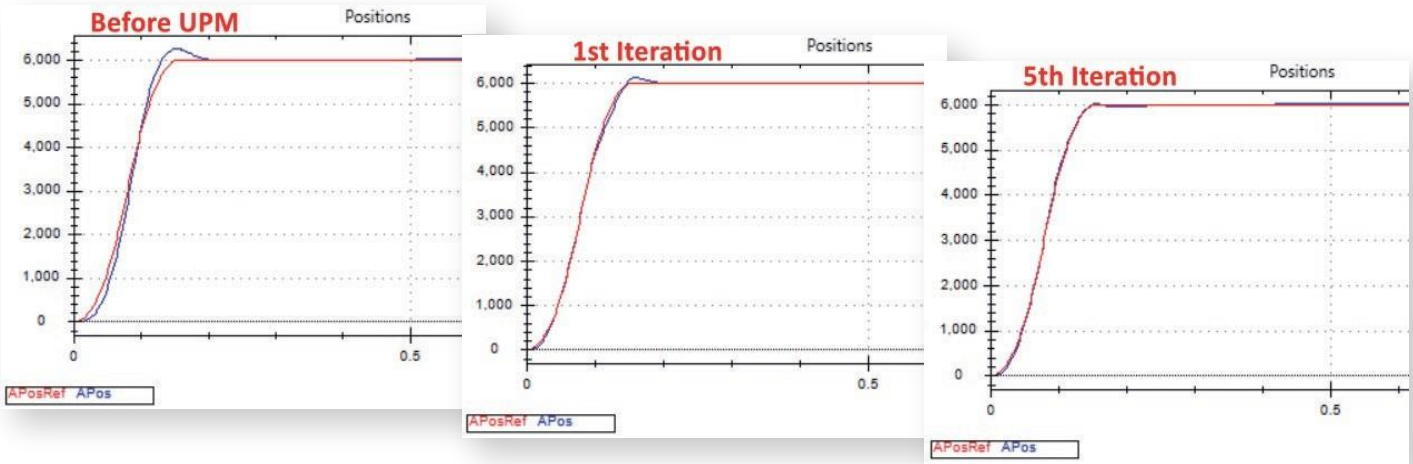
Ultra-Precision Mode

Agito' Ultra-Precision Mode (UPM), is a series of state-of-the-art algorithms to automatically improve the system performance. The Ultra Precision Mode covers the following optimization algorithms: Constant-Velocity, Repeated-Motion and Disturbance-Rejection. The Ultra Precision Mode algorithms are automatic and self-learning. The Ultra Precision Mode algorithms do not affect the bandwidth of the system (thus, do not affect its stability!). Yet, it significantly improves the system performance.



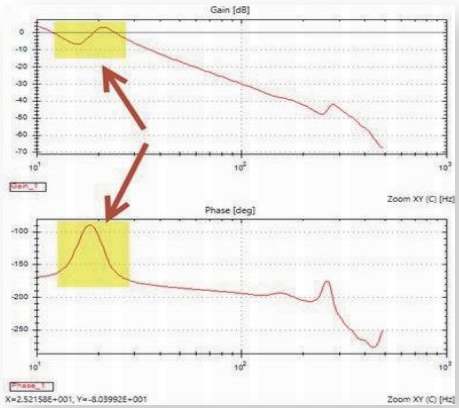
For example, the Constant-Velocity UPM improves the performance during constant velocity motion. The tool monitors the motion signals during constant velocity motion and automatically configure the relevant parameters to optimize position and velocity tracking error during such motions.

The Repeated-Motion UPM, on the other hand, optimizes the settling time for a repetitive motion. The algorithm will learn the same motion in iterations and results in better performance (less overshoot, shorter settling time), lower position tracking error, and even reject external periodical disturbance.



In Disturbance Rejection UPM, any disturbance, whether a result of the motion itself (like a machine with a flexible base), or external disturbance, is significantly rejected when the algorithm is activated, with minimal effect on the system stability and the response to the motion trajectory. The algorithm is optimally performing at frequencies from a few Hertz to tens of Hertz (the typical range of vibrations due to shock absorbers and other system flexibilities).

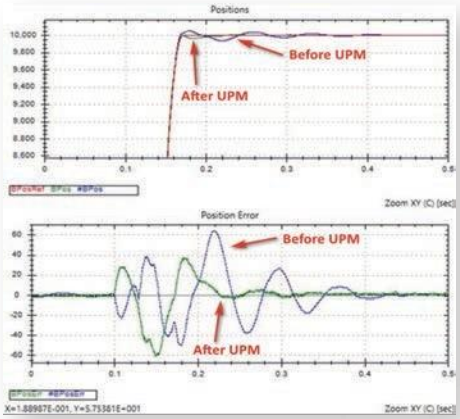
In the picture on the right, it shows the Bode plot of plant that is mounted on a flexible base (refer to frequencies 15-20 Hz that shows the base flexibility.



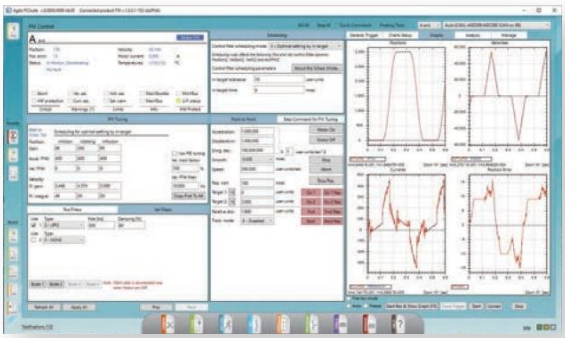
This plant is commanded, in closed loop, to perform an aggressive point to point motion, which, even with the high bandwidth of the closed loop, creates long time oscillations at the end of the motion, due to the base flexibility, that results with a very long settling time.

In the picture on the right, it shows a zoom in at the end of this point to point motion, showing the position reference and the actual position (upper chart) as well as the position error (lower chart).

The blue lines are the position and the position error without the Ultra Precision Mode while the green lines are once the mode is activated.



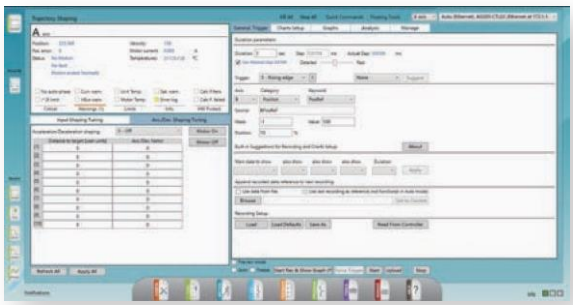
Advanced Gain Scheduling



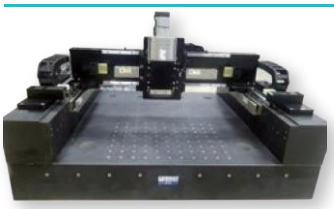
In cases when one set of control gains cannot fulfil the servo performance due to changing conditions, the controller can be configured to switch automatically between up to 5 sets of control gains based on different motion status, positions, speeds, temperature and many other conditions.

Input Shaping, Profile Shaping and Machine Vibration Control

Input shaping works by convolving additional signals to the desired motion profile to reduce machine vibration. Profile shaping works by automatically changing the acceleration and deceleration setting at different distance to the target position. This can be more effective than setting a constant jerk parameter or a constant smoothing factor. Machine Vibration Control is a feature to use an external MVC sensor to measure machine vibration, allowing the controller to improve servo performance based on the sensor input. All the 3 features are highly effective in tackling machine vibration issue, especially when acceleration is very high.



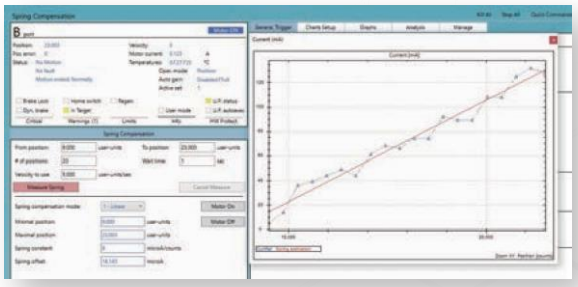
Active-Yaw Gantry Control



Active Yaw gantry control allows servo control in the yaw direction to constantly maintain a consistent orthogonality for the gantry. Together with error mapping, this feature provides the best control performance for flexible gantry stage, ideal for any high precision XY applications.

Spring and Friction Compensation

Systems with spring force exerted on the motor can use this feature to automatically compensate the varying spring force at different position. This eliminate the difference in performance at different position for the same control gains. Friction compensation helps to eliminate the high error at the start of motion due to static friction.



General Motion Modes

CNC GEAR JOG PTP JOYS ECAM

Almost all motion parameters can be ultimately modified on-the-fly during the motion and the motion will automatically respond to the change.

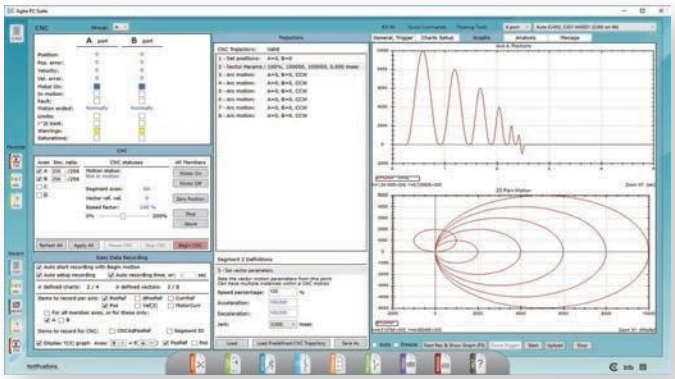
- Point to Point, absolute or relative, single or repetitive, tracking mode.
- Homing: easily building complex Homing scenarios or to load predefined scenarios.
- Jogging
- Gearing (direct and indirect).
- ECAM (see below).
- Joystick, position and velocity, direct and indirect.
- Pulse/Direction, direct and indirect.
- FIFO
- Vector
- Comprehensive CNC motion mode (see below)

CNC and Contour Motion (G-codes)

CNC

Commonly used in laser and 3D printing applications, the controller supports a few types of CNC-like motions (e.g. continuous linear and circular segments). The PCSuite software includes a G-codes parser to convert some of the G-codes commands into the controller's commands. The parser can, at the same time, add arc corners between segments, adjusting corner speed according to axes' acceleration limitations.

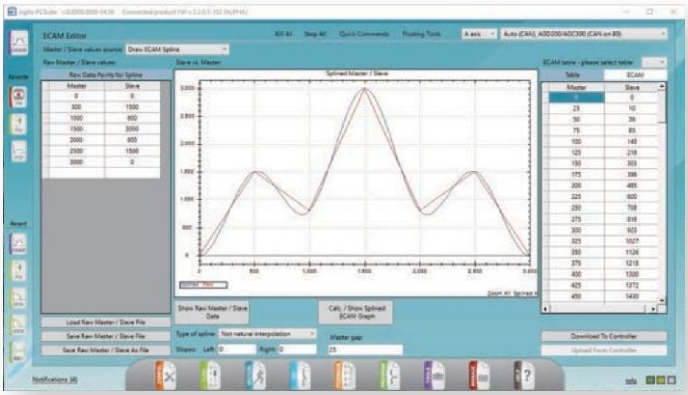
With the CNC engine, the controller is capable to control and drive a 3D printer and laser marking/cutting machine easily. For example, a 3D printer typically consists of an XY stage with an extruder motor and a Z-axis table. The PCSuite G-codes parser could import the G-codes from a slicer software and map the extruder command to the respective extruder axis. The controller can also close the temperature PID loops of the heaters with RTD feedback sensors and control the cooling fans with PWM speed commands.



The controller can communicate with the HMI, PC or other devices like Raspberry Pi over Ethernet to receive the CNC motion segments into a circular buffer, the controller will be able to print object of any size and complexity without memory limitation.

ECAM / Gearing / Joystick / Handwheel

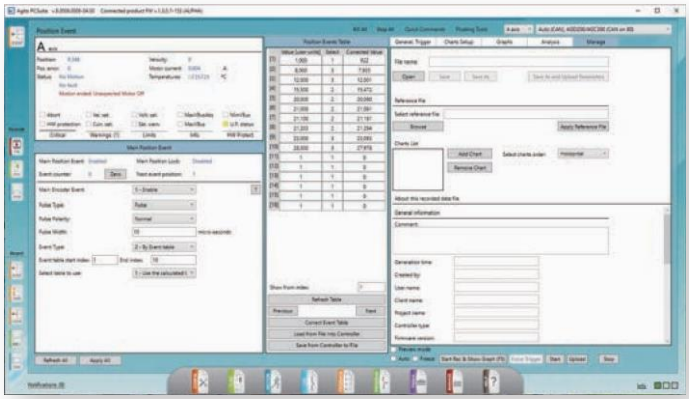
Gearing is a feature where the slave axis follows a master axis' position command or feedback position in a simple scaling factor. For a more complex following profile, like a mechanical cam system, the feature is known as ECAM. Agito ECAM supports single, multiple and infinite cycles, with blending and with dedicated profiles to accelerate into or decelerate from the cyclic ECAM profile. These features provide a flexible and easy way to define multi-axis coordinated motion. For external manual profiler, machine operator can use a Joystick or Handwheel to manually move the motor to any position at any speed.



Position Lock and Event

Position Lock refers to locking the encoder feedback value when an external event, connected to a digital input or encoder index, occurred. This feature is also commonly known as "position capture". Locked values, as well as their time, are collected in arrays for offline analysis by the user, if needed.

Position Event, on the other hand, is to have the controller generate an event by outputting a digital pulse to one or a few digital outputs. This feature is also commonly known as "position compare" or PEG. The controller can trigger the events based on fixed position interval or based on a user defined table. By supporting multiple digital outputs, multiple external devices such as camera, dispenser and laser can be triggered at their respective positions in a single pass of motion. For example, in a single move from 0 count to 4000 count, the controller can trigger a dispenser at 100 and the camera at 200 to inspect the quality of dispensing in a single move. This would improve the machine throughput significantly.

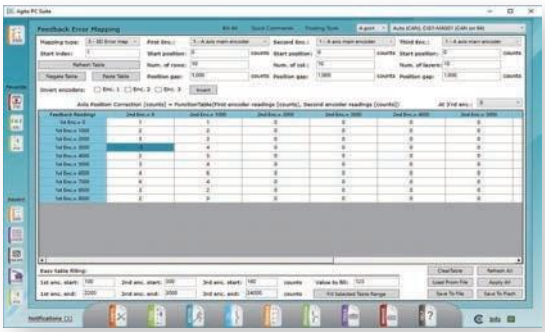


Both Position Lock and Position Events, for incremental encoders, are handled by the hardware with an accuracy of 1 encoder count.

For Position Events, the table of values can be inversed-corrected using the (1D, 2D or 3D) error mapping table, to ensure the events will occur at the exact physical location of the load.

Error Mapping: 1D, 2D or 3D

Agito controllers can compensate encoder feedback errors based on the error mapping tables, starting with the simplest one-dimensional (1D) error correction table and up to 2D and 3D tables for overall system mapping. The controller will do linear interpolation between the given points. Position Events can be configured to use the compensated position.



Complex Kinematics DSP Functions

Advanced user can program complex kinematics equations into the real-time DSP interrupt routines, known as DSP User Functions, to perform non-standard kinematic transformation. For example, a miniature tripod stage, shown in the picture on the right, with 3 vertical linear axes can be transformed into roll, pitch and Z-axis motion. Since the tripod stage is actuated by 3 direct-drive voice coil motors, the force control feature can also be used to ensure the contact force acting on the object carried by the tripod can be controlled precisely.

Another example of complex kinematics is Akribis' Parallel SCARA robot where 2 rotary joints are transformed into XY motion. Optionally, a secondary arm can be installed at the opposite side to copy the same XY motion as the primary arm. Together with a Z and Theta axes, user can send position commands in XYZ and Theta coordinates.

Customized DSP Functions

In additional to writing complex kinematics functions in the DSP User Functions, user can access all the I/Os from the DSP User Functions. The picture on the right shows a Medical Robot to assist inpatient rehabilitation from strokes and other neurological disorders. The system includes the AGD301 drive, with 6 feedback encoders (including 3 encoders read by DSP User Functions over differential inputs) on robot arm and 5 force sensors. With the data from these feedback sensors, the additional codes could be added to the DSP User Functions to compensate the robot arm's weight and inertia, while applying the required torque on the motors.

Product Part Number	Description	Optional Accessories	Accessories Description
AGC300-ET	3-axis Controller (Gen1)	AGC300-ET-CK	AGC300-ET Connector Kit
AGC301-ET	3-axis Controller (Gen2) with 12-bit analog input	AGC301-ET-CK	AGC301-ET Connector Kit
AGC301-ET-001	3-axis Controller (Gen2) with 16-bit analog input		
AGD155-PA-2A03	Low Cost Single-axis Driver – 230Vac, 3Arms continuous, 9Arms peak	AGD155-PA-CK	AGD155-PA Connector Kit
AGD155-PA-2A06	Low Cost Single-axis Driver – 230Vac, 6Arms continuous, 18Arms peak		
AGD155-AF-2A06	Single-axis Driver – 230Vac, 6Arms continuous, 18Arms peak	AGD155-AF-CK	AGD155-AF Connector Kit
AGD155-AF-2A10	Single-axis Driver – 230Vac, 10Arms continuous, 20Arms peak		
AGD200-ET-2D01	Dual-axis Drive – 90Vdc, 1.4Arms continuous current	AGD200-ET-CK	AGD200-ET Connector Kit
AGD200-ET-2D02	Dual -axis Drive – 90Vdc, 2.8Arms continuous current		
AGD200-ET-2D05	Dual -axis Drive – 90Vdc, 5.6Arms continuous current		
AGD301-ET-2D05	3-axis Drive – 90Vdc, 5.6 Arms continuous current	AGD301-ET-CK	AGD301-ET Connector Kit
AGD301-ET-2D09-001	3-axis Drive – 90Vdc, 9 Arms continuous current, with 16-bit analog input		
AGB600-6C	6-axis Controller	AGD301-ET-CK	AGD301-ET Connector Kit
AGB600-6C6D	6-axis controller with 6 integrateddrives		
AGB600-6C3D	6-axis controller with 3 integrateddrives		
AGM800-CI	Central-i 8-axis Master	AGM800-CI -CK	AGM800-CI Connector Kit
AGM400-CI	Central-i 4-axis Master	AGM400-CI-CK	AGM800-CI Connector Kit
AGA101-CI-2D01	Central-i remote amplifier – 90Vdc, 1.4Arms continuous current	AGA101-CI-CK	AGA101-CI Connector Kit
AGA101-CI-2D02	Central-i remote amplifier – 90Vdc, 2.8Arms continuous current		
AGA101-CI-2D05	Central-i remote amplifier– 90Vdc, 5.6Arms continuous current		
AGA102-CI-1D01	Central-i remote amplifier– 48Vdc, 1.4Arms continuous current	AGA102-CI-CK	AGA102-CI Connector Kit
AGA102-CI-1D02	Central-i remote amplifier – 48Vdc, 2.8Arms continuous current		
AGA102-CI-1D05	Central-i remote amplifier – 48Vdc, 5.6Arms continuous current		
AGA155-CI-2A03	Central-i remote amplifier – 230Vac, 3Arms continuous, 9Arms peak	AGA155-CI-CK	AGA155-CI Connector Kit
AGA155-CI-2A06	Central-i remote amplifier – 230Vac, 6Arms continuous, 18Arms peak		
AGA155-CI-2A10	Central-i remote amplifier – 230Vac, 10Arms continuous, 20Arms peak		
AGIO01-CI-1608	Central-i remote I/O module – 16 Input, 8 Output	AGIO01-CI-CK	AGIO01-CI Connector Kit
AGIO02-CI-3216	Central-i remote I/O module – 32 Input, 16 Output	AGIO02-CI-CK	AGIO02-CI Connector Kit
AGL101-CI	Central-i remote third-party drive adapter	AGL101-CI-CK	AGL101-CI Connector Kit
AGL102-CI	Central-i remote third-party drive adapter - Lite	AGL102-CI-CK	AGL102-CI Connector Kit

1:Drive refers to controller with one or more integrated amplifiers within one enclosure. All drives can be programmed and executed in standalone mode without the need to have an external controller.
2:Amplifier refers to power amplifying module that does not support standalone operation. There must be an external master controller to perform closed loop control.

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